

In the claims:

Please amend the claims as follows:

1. (currently amended) ~~Device~~ A device for on-line monitoring of flow quantities in a system (1) comprising a flow-creating device (12) such as a pump or a fan, comprising:

means (42; 50, 51, 52; 57) for obtaining a measure of a torque (T) of said flow-creating device (12);

means (43; 50, 51, 57) for obtaining a measure of a rotational speed (n) of said flow-creating device (12); and

means (48) for determining a value of a flow rate (Q) through said flow-creating device (12),

~~characterised by:~~

means (44) for calculating a value of a mechanical input power (P_m) of said flow-creating device (12), connected to said means (42; 50, 51, 52; 57) for obtaining a measure of a torque (T) and said means (43; 50, 51, 57) for obtaining a measure of a rotational speed;

storage means (46) for storage of data (47) representing a predetermined relation between mechanical input power (P_m) and flow rate (Q) through said flow-creating device (12); and

whereby said means (48) for determining a value of a flow rate (Q) is connected to said means (44) for calculating a value of a mechanical input power (P_m) and to said storage means (46);

said means for obtaining a measure of a rotational speed (n) in turn comprising:

at least one current sensor (51) for measuring an input current (I) of an electric

motor (20), said electric motor (20) giving said torque (T) to said flow-creating device (12);

at least one voltage sensor (50) for measuring an input voltage (U) over said electric motor (20); and

means (57) for determining a value of said rotational speed (n), connected to said current sensor (51), said voltage sensor (50) and said storage means (46);

said storage means (46) being further arranged for storage of data (58) representing a predetermined relation between input current (I) and input voltage (U) of said electric motor (20) and rotational speed (n) of said electric motor (20).

2. (currently amended) ~~Device~~ The device according to claim 1, ~~characterised in that~~ wherein said means for obtaining a measure of a torque (T) in turn comprises:

at least one current sensor (51) for measuring an input current (I) of said electric motor (20);

at least one voltage sensor (50) for measuring an input voltage (U) over said electric motor (20); and

means (52; 57) for determining a value of said torque (T), connected to said current sensor (51), said voltage sensor (50) and said storage means (46);

said storage means (46) being further arranged for storage of data (54) representing a predetermined relation between input current (I) and input voltage (U) of said electric motor (20) and output torque (T) of said electric motor (20).

3. (currently amended) ~~Device~~ The device according to claim 1, further comprising: ~~or~~ 2, characterised by:

means for determining a value of a flow-creating device efficiency (η_P), connected to said means (48) for determining a value of said flow rate (Q) and said storage means (46);

said storage means (46) being further arranged for storage of data (56) representing a predetermined relation between flow rate (Q) and flow-creating device efficiency (η_P) for said flow-creating device (12).

4. (currently amended) ~~Device~~ The device according to claim 3, ~~characterised by~~ further comprising means for determining a value of an electric motor efficiency (η_E), connected to said current sensor (51), said voltage sensor (50) and said means (44) for calculating a value of a mechanical input power (P_m).

5. (currently amended) ~~Device~~ The device according to claim 4, ~~characterised by~~ further comprising means for determining a value of a total efficiency (η_T), connected to said means (48) for determining a value of a flow-creating device efficiency (η_P) and said means for determining a value of an electric motor efficiency (η_E).

6. (currently amended) ~~Device~~ The device according to ~~any of the claims 1 to 5,~~ characterised by claim 1, further comprising a diagnosing means (60), connected to said determining (48) or calculating (44) means, for evaluation of time dependencies of mechanical input power (P_m), flow (Q) or efficiency (η_P , η_T , η_E) quantities.

7. (currently amended) ~~Device~~ The device according to claim 6, ~~characterised in that~~ wherein said diagnosing means (60) comprises a processor and is connected to said storage

means (46), said storage means (46) being arranged for storing data representing said time dependencies.

8. (currently amended) ~~Device~~ The device according to claim 7, ~~characterised in that wherein~~ said storage means (46) is arranged for storing data representing comparison curves of earlier registered time dependencies.

9. (currently amended) ~~Device~~ The device according to ~~any of the claims 1 to 8,~~ characterised by claim 1, further comprising a monitor (32), connected to said determining means (48), for monitoring flow (Q) or efficiency (η_P , η_T , η_E) quantities.

10. (currently amended) ~~Soft~~ A soft starter device comprising a device for monitoring flow quantities according to ~~any of the claims 1 to 9~~ claim 1.

11. (currently amended) ~~Frequency~~ A frequency inverter device comprising a device for monitoring flow quantities according to ~~any of the claims 1 to 9~~ claim 1.

12. (currently amended) ~~Flow~~ A flow system (1), having a flow-creating device (12) such as a pump or a fan arranged for moving a fluid, and means for on-line monitoring of flow quantities, said means for monitoring flow quantities in turn comprising:

means (~~42; 50, 51, 52; 57~~) for obtaining a measure of a torque (T) of said flow-creating device (12);

means (~~43; 50, 51, 57~~) for obtaining a measure of a rotational speed (n) of said flow-

creating device (12); and

means (48) for determining a value of a flow rate (Q) through said flow-creating device (12),

~~characterised in that~~ wherein said means for monitoring flow quantities further comprises:

means (44) for calculating a value of a mechanical input power (P_m) of said flow-creating device (12), connected to said means (42; 50, 51, 52; 57) for obtaining a measure of a torque (T) and said means (43; 50, 51, 57) for obtaining a measure of a rotational speed;

storage means (46) for storage of data (47) representing a predetermined relation between mechanical input power (P_m) and flow rate (Q) through said flow-creating device (12); and

whereby said means (48) for determining a value of a flow rate (Q) is connected to said means (44) for calculating a value of a mechanical input power (P_m) and to said storage means (46);

said means for obtaining a measure of a rotational speed (n) in turn comprising:

at least one current sensor (51) for measuring an input current (I) of an electric motor (20), said electric motor (20) giving said torque (T) to said flow-creating device (12);

at least one voltage sensor (50) for measuring an input voltage (U) over said electric motor (20); and

means (57) for determining a value of said rotational speed (n), connected to said current sensor (51), said voltage sensor (50) and said storage means (46);

said storage means (46) being further arranged for storage of data (58) representing a predetermined relation between input current (I) and input voltage (U) of said electric motor (20) and rotational speed (n) of said electric motor (20).

13. (currently amended) ~~Flow~~ The flow system according to claim 12, ~~characterised in that wherein~~ said means for obtaining a measure of a torque (T) in turn comprises:

at least one current sensor (51) for measuring an input current (I) of said electric motor (20);

at least one voltage sensor (50) for measuring an input voltage (U) over said electric motor (20); and

means (52; 57) for determining a value of said torque (T), connected to said current sensor (51), said voltage sensor (50) and said storage means (46);

said storage means (46) being further arranged for storage of data (54) representing a predetermined relation between input current (I), input voltage (U) of said electric motor (20) and output torque (T) of said electric motor (20).

14. (currently amended) ~~Flow~~ The flow system according to claim 12, ~~wherein or 13,~~ ~~characterised in that~~ said means for monitoring flow quantities further comprises:

means (48) for determining a value of a flow-creating device efficiency (η_P), connected to said means (48) for determining a value of said flow rate (Q) and said storage means (46);

said storage means (46) being further arranged for storage of data (56) representing a predetermined relation between flow rate (Q) and flow-creating device efficiency (η_P) for said flow-creating device (12).

15. (currently amended) ~~Flow~~ The flow system according to ~~any of the claims 12 to 14,~~ ~~characterised by claim 12, further comprising~~ a diagnosing means (60), connected to said

determining (48) or calculating (44) means, for evaluation of time dependencies of mechanical input power (P_m), flow (Q) or efficiency (η_P, η_T, η_E) quantities.

16. (currently amended) ~~Flow~~ The flow system according to ~~any of the claims 12 to 15,~~
~~characterised by claim 12, further comprising~~ a monitor (32), connected to said determining
means (48), for monitoring flow (Q) or efficiency (η_P, η_T, η_E) quantities.

17. (currently amended) ~~Flow~~ The flow system according to claim 16, ~~characterised in~~
~~that wherein~~ said monitor (32) is positioned remotely in relation to said flow-creating device
(12).

18. (currently amended) ~~Device~~ A device for on-line diagnostics of performance in a
system (1) comprising a flow-creating device (12) such as a pump or a fan, comprising:

means (42; 50, 51, 52; 57) for obtaining a measure of a torque (T) of said flow-creating
device (12);

means (43; 50, 51, 57) for obtaining a measure of a rotational speed (n) of said flow-
creating device (12); and

storage means (46),

~~characterised by:~~

means (44) for calculating a value of a mechanical input power (P_m) of said flow-
creating device (12), connected to said means (42; 50, 51, 52; 57) for obtaining a measure of a
torque (T) and said means (43; 50, 51, 57) for obtaining a measure of a rotational speed;

diagnosing means (60), connected to said calculating means (44), for evaluation of time

dependencies of mechanical input power (P_m);

said means for obtaining a measure of a rotational speed (n) in turn comprising:

at least one current sensor (I) for measuring an input current (I) of an electric motor (20); said electric motor (20) giving said torque (T) to said flow-creating device (12);

at least one voltage sensor (U) for measuring an input voltage (U) over said electric motor (20); and

means (57) for determining a value of said rotational speed (n), connected to said current sensor (I), said voltage sensor (U) and said storage means (46);

said storage means (46) being arranged for storage of data (58) representing a predetermined relation between input current (I) and input voltage (U) of said electric motor (20) and rotational speed (n) of said electric motor (20).

19. (currently amended) ~~Device~~ The device according to claim 18, ~~characterised in that~~ wherein said storage means (46) is arranged for storing data representing said time dependencies.

20. (currently amended) ~~Device~~ The device according to claim 19, ~~characterised in that~~ wherein said storage means (46) comprises data is arranged for storing data representing comparison curves of earlier registered time dependencies.

21. (currently amended) ~~Method~~ A method of on-line monitoring flow quantities in a system (1) comprising a flow-creating device (12) such as a pump or a fan, the method comprising ~~the steps of:~~

obtaining a measure of a torque (T) of said flow-creating device (12);

obtaining a measure of a rotational speed (n) of said flow-creating device (12), and
determining a value of a flow rate (Q) through said flow-creating device (12), based on
said measure of a torque (T) and said measure of a rotational speed (n),

~~characterised by the further step of:~~

calculating a value of a mechanical input power (P_m) of said flow-creating device (12)
based on said measure of a torque (T) and said measure of a rotational speed (n);

said determining step using said mechanical input power (P_m) and a predetermined
relation between mechanical input power (P_m) and flow rate (Q) through said flow-creating
device (12);

said step of obtaining a measure of a rotational speed (n) in turn comprising ~~the steps of:~~

measuring an input current (I) of an electric motor (20), said electric motor (20)
giving said rotational speed (n) to said flow-creating device (12);

measuring an input voltage (U) over said electric motor (20); and

determining a value of said rotational speed (n), using said input current (I) and
input voltage (U) and a predetermined relation between input current (I), input voltage (U) and
rotational speed (n) of said electric motor (20).

22. (currently amended) ~~Method~~ The method according to claim 21, ~~characterised by the
further step of~~ further comprising:

controlling parameters of said system (1) based on said flow rate (Q).

23. (currently amended) ~~Method~~ The method according to claim 21, further comprising:
~~or 22, characterised by the further step of:~~

empirically determining said predetermined relation between mechanical input power (P_m) and flow rate (Q) through said flow-creating device (12) prior to installation of said flow-creating device (12).

24. (currently amended) ~~Method~~ The method according to claim 21, ~~22 or 23,~~
~~characterised in that~~ wherein said step of obtaining a measure of a torque (T) in turn comprises
~~the steps of:~~

measuring an input current (I) of said electric motor (20);

measuring an input voltage (U) over said electric motor (20); and

determining a value of said torque (T), using said input current (I) and input voltage (U)
and a predetermined relation between input current (I), input voltage (U) and torque (T) of said
electric motor (20).

25. (currently amended) ~~Method~~ The method according to claim 24, ~~characterised by the~~
~~further step of~~ further comprising:

empirically determining said predetermined relation between input current (I), input
voltage (U) and torque (T) of said electric motor (20) prior to installation of said flow-creating
device (12).

26. (currently amended) ~~Method~~ The method according to ~~any of the claims 21 to 25,~~
~~characterised by the further step of~~ claim 21, further comprising:

empirically determining said predetermined relation between input current (I), input
voltage (U) and rotational speed (n) of said electric motor (20) prior to installation of said flow-

creating device (12).

27. (currently amended) ~~Method~~ The method according to ~~any of the claims 21 to 26,~~
~~characterised by the further step of claim 21, further comprising:~~

determining a value of a flow-creating device efficiency (η_P), using said value of said
flow rate (Q) through said flow-creating device (12) and a predetermined relation between flow
rate (Q) and flow-creating device efficiency (η_P) for said flow-creating device (12).

28. (currently amended) ~~Method~~ The method according to ~~any of the claims 21 to 27,~~
~~characterised by the further step of claim 21, further comprising:~~

registering of time dependencies of said mechanical input power (P_m), flow (Q) or
efficiency (η_P , η_T , η_E) quantities;

evaluating said time dependencies for diagnosing of the operation of said flow-creating
device (12).

29. (currently amended) ~~Method~~ The method according to claim 28, ~~characterised in~~
~~that wherein~~ said step of registering comprises storing of said time dependencies in a storage
means (46).

30. (currently amended) ~~Method~~ The method according to claim 29, ~~characterised in~~
~~that wherein~~ said step of evaluation comprises comparing said time dependencies with earlier
registered time dependencies.

31. (currently amended) ~~Method~~ The method according to ~~any of the claims 27 to 30,~~
~~characterised by the further step of~~ claim 27, further comprising:

determining a value of an electric motor efficiency (η_E), using said value of said
mechanical input power (P_m), said input current (I) and said input voltage (U).

32. (currently amended) ~~Method~~ The method according to claim 31, ~~characterised by the~~
~~further step of~~ further comprising:

determining a value of a total efficiency (η_T), multiplying said flow-creating device
efficiency (η_P) and said electric motor efficiency (η_E).

33. (currently amended) ~~Method~~ A method of on-line diagnosing of performance of a
system comprising a flow-creating device (12) such as a pump or a fan, ~~comprising the steps of~~
the method comprising:

obtaining a measure of a torque (T) of said flow-creating device (12); and
obtaining a measure of a rotational speed (n) of said flow-creating device (12),
~~characterised by the further steps of:~~
calculating a value of a mechanical input power (P_m) of said flow-creating device (12)
based on said measure of a torque (T) and said measure of a rotational speed (n);
registering of time dependencies of said mechanical input power (P_m); and
evaluating said time dependencies for diagnosing of the operation of said flow-creating
device (12);
said step of obtaining a measure of a rotational speed (n) in turn comprising ~~the steps of:~~
measuring an input current (I) of an electric motor (20), said electric motor (20)

giving said rotational speed (n) to said flow-creating device (12);

measuring an input voltage (U) over said electric motor (20); and

determining a value of said rotational speed (n), using said input current (I) and input voltage (U) and a predetermined relation between input current (I), input voltage (U) and rotational speed (n) of said electric motor (20).

34. (currently amended) ~~Method~~ The method according to claim 33, ~~characterised in that~~ wherein said step of registering comprises storing of said time dependencies in a storage means (46).

35. (currently amended) ~~Method~~ The method according to claim 34, ~~characterised in that~~ wherein said step of evaluation comprises comparing said time dependencies with earlier registered time dependencies.

36. (currently amended) A computer program product comprising computer code means and/or software code portions for making a processor perform the steps of ~~any of the claims 21 to 35~~ claim 21.

37. (currently amended) ~~A~~ The computer program product according to claim 36 supplied via a network, such as Internet.

38. (currently amended) A computer readable medium containing a computer program product according to claim 36 ~~or 37~~.

39. (currently amended) A data storage means arranged in a softstarter or frequency converter of an electric motor (20) driving a flow-creating device (12) such as a pump or fan, comprising stored data (47) representing a predetermined relation between mechanical input power (P_m) of said flow-creating device (12) and flow rate(Q) through said flow-creating device (12).

40. (currently amended) A data storage means according to claim 39, characterised by further comprising stored data (58) representing a predetermined relation between input current (I) and input voltage (U) of said electrical motor (20) and output torque (T) of said electrical motor (20).

41. (new) A computer program product comprising computer code means and/or software code portions for making a processor perform the steps of claim 33.

42. (new) A computer readable medium containing a computer program product according to claim 41.